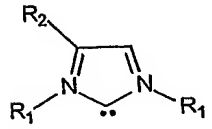
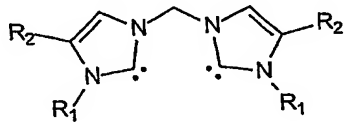
CLAIMS

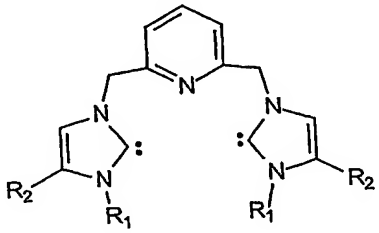
We claim:

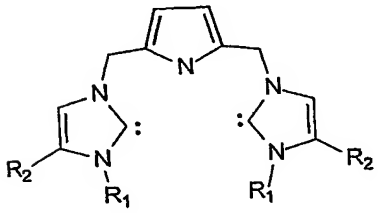
1. A method for inhibiting at least one of microbial, fungal, and viral growth comprising the step of administering an effective amount of a silver complex of an N-heterocyclic carbene.

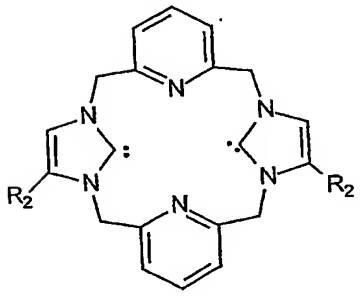
2. The method of claim 1, wherein the N-heterocyclic carbene is selected from the group consisting of compounds represented by the following formulae:

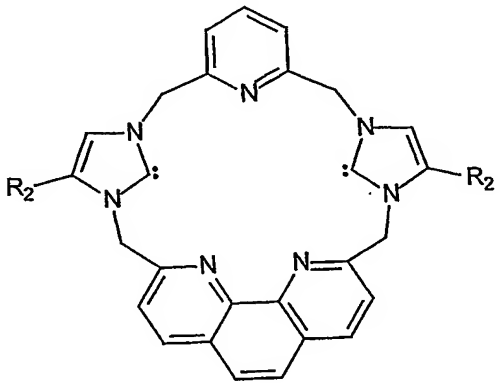








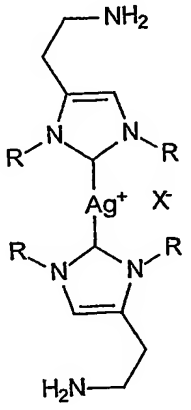




wherein R_1 and R_2 are, independently or in combination, hydrogen or a C_1-C_{12} organic group selected from the group consisting of alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, alkenyl, cycloalkenyl, substituted cycloalkenyl, alkynyl, aryl, substituted aryl, arylalkyl, alkylaryl, pyrroles, pyridines, thiophenes and alkoxy.

3. The method of claim 1, wherein the silver complex of a N-heterocyclic carbene is

selected from the group consisting of compounds represented by the following formulae:



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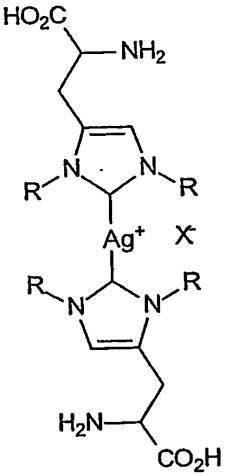
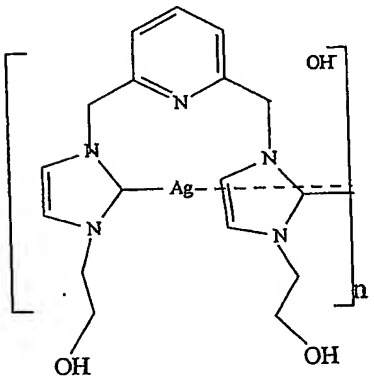


wherein R is selected from the group consisting of hydrogen, alkyl, cycloalkyl, alkenyl, cycloalkenyl, alkynyl, aryl, arylalkyl, alkylaryl, heterocyclic, and alkoxy groups and substituted derivatives thereof, and X is an anion.

4. The method of claim 1, wherein the silver complex of an N-heterocyclic carbene is selected from the group consisting of compounds represented by the following formulae:



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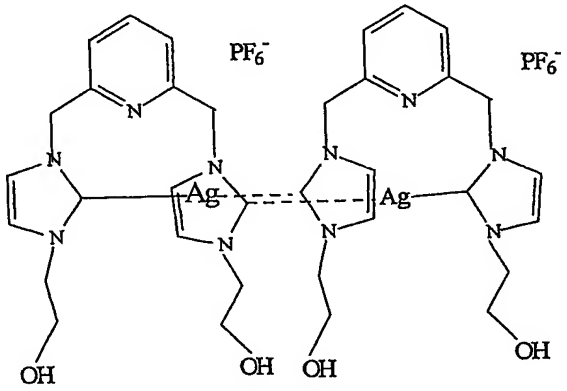
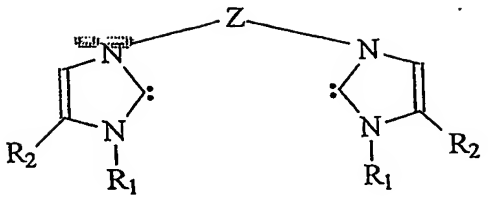


5. An N-heterocyclic carbene represented by the formula:



wherein Z is a heterocyclic group, and R_1 and R_2 are, independently or in combination, hydrogen or a C_1-C_{12} organic group selected from the group consisting of alkyl, cycloalkyl, alkenyl, cycloalkenyl, alkynyl, aryl, arylalkyl, alkylaryl, heterocyclic, alkoxy groups, and substituted derivatives thereof.

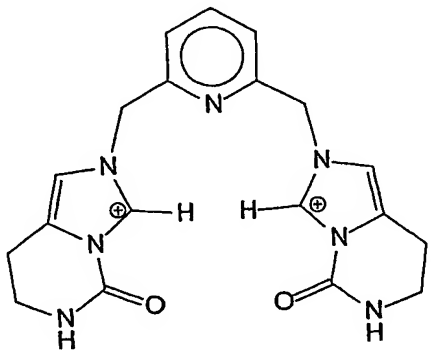
6. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, each R_1 is independently a C_1-C_6 hydroxyalkyl, and R_2 is hydrogen.

7. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, each R_1 is independently a C_2-C_3 hydroxyalkyl, and R_2 is hydrogen.

8. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, both R_1 groups together form a dimethyl phenanthroline group, and R_2 is hydrogen.

9. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, and each adjacent R_1 and R_2 together form a substituted alkyl group.

10. The N-heterocyclic carbene according to claim 9, wherein the N-heterocyclic carbene is represented by formula 26.



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11. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, both

R_1 groups form a single aryl group, and R_2 is hydrogen.

12. The N-heterocyclic carbene according to claim 11, wherein the aryl group is dimethyl phenanthroline.

13. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group and R_2 is a substituted alkyl.

14. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethylpyridine group, R_1 is a C_1-C_6 alkyl, and R_2 is a C_1-C_6 amino alkyl.

15. The N-heterocyclic carbene according to claim 5, wherein Z is a dimethyl pyrrole group, each R_1 is independently a C_1-C_6 alkyl, and R_2 is hydrogen.

16. The N-heterocyclic carbene according to claim 5, additionally complexed to silver.

17. The N-heterocyclic carbene according to claim 5, additionally complexed to a radioactive metal.

18. A method for synthesizing a radiopharmaceutical compound comprising the steps of:

reacting an imidazolium salt with either a transition-metal complex or a base to produce an N-heterocyclic carbene; and

reacting the N-heterocyclic carbene with a metal to form a metal complex.

19. A method for synthesizing an antibiotic compound comprising:

reacting an imidazolium salt with a transition metal complex or a base to thereby produce an N-heterocyclic carbene; and

reacting the N-heterocyclic carbene with a silver compound to thereby produce a silver complex with the N-heterocyclic carbene.

20. A method for treating cancer cells comprising the step of administering an effective amount of a complex of an N-heterocyclic carbene and a radioactive metal.

21. A method of creating an image of one or more tissues within a patient comprising the step of

administering an effective amount of a complex of a N-heterocyclic carbene and a radioactive metal.

22. A nanofiber comprising:

a fiber-forming material; and

a metal complex of an N-heterocyclic carbene.

23. The nanofiber of claim 22, wherein the metal is Ag or a radioactive element selected from the group consisting of transition metals, lanthanide series and actinide series.

24. A method for manufacturing the nanofiber of claim 22 comprising the steps of:

electrospinning an electrospinnable solution that has a fiber-forming material and a metal complex of an N-heterocyclic carbene.

25. A wound dressing comprising the nanofiber of claim 22.

26. A radiopharmaceutical compound comprising a radioactive-metal complex of an N-heterocyclic carbene.

27. The radiopharmaceutical of claim 26, wherein the N-heterocyclic carbene has a peptide moiety, a polyamine moiety, or a combination thereof.

28. A method for treating a cancerous tumor comprising the step of:

administering an effective amount of a radioactive-metal complex of an N-heterocyclic carbene.

29. The method of claim 28, wherein the N-heterocyclic carbene has a peptide moiety, a polyamine moiety, or a combination thereof.

30. The method of claim 28, wherein the radioactive metal is an element selected from the group consisting of transition metals, the lanthanide series, and the actinide series.

31. The method of claim 28, wherein the metal is Ag, Rh, Ga, or Tc.

32. A method for synthesizing a pharmaceutical or radiopharmaceutical comprising the step of performing a carbene transfer reaction on a metal complex of an N-heterocyclic carbene.

33. The method of claim 32, wherein a silver complex of an N-heterocyclic carbene is a carbene transfer reagent.